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Quarterly Report Q3FY04

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Development of a Rolling Process Design Tool for Use in Improving Hot Roll Slab Recovery

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Quarterly Report: Q3 FY04

In this quarter, an FEM simulation was carried out to test the Johnson-Cook failure model for validation. The model specifies a failure strain as a function of triaxiality, strain rate and temperature. The compressive pressure at the center region of the slab becomes tensile right after high reduction, which changes the value of the stress triaxiality dramatically. Since the fracture is typically initiated by high stress concentration at a sharp notch, capturing the correct notch geometry at the center of the slab center becomes important. In our simulation, fracture occurs at the notch region owing to crack-like geometry that gives high stress concentration at the notch tip as shown in Figure 1. As the slab is continuously moved to the right direction for reduction, the portion above the fractured element has tensile stress similar to mode I type fracture. A snapshot of fractured (or "alligatored") slab and a simulation is given in Figure 2. Currently, more analyses are being done to understand the fracture behavior more thoroughly.

Also, LLNL personnel presented the project work at two conferences:

1) 2004 NNSA Future Technologies Conference, Washington DC, May 17-19, 2004 poster presentation
2) The 8th International Conference on Numerical Methods in Industrial Forming Processes (2004 NUMIFORM), Ohio State University, June 13-17, 2004, paper presentation.

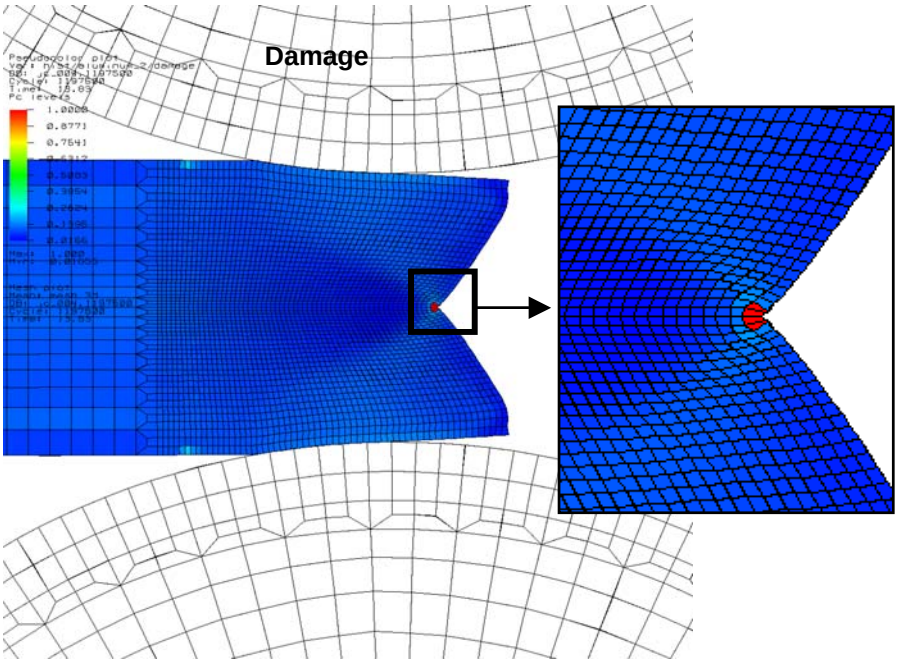
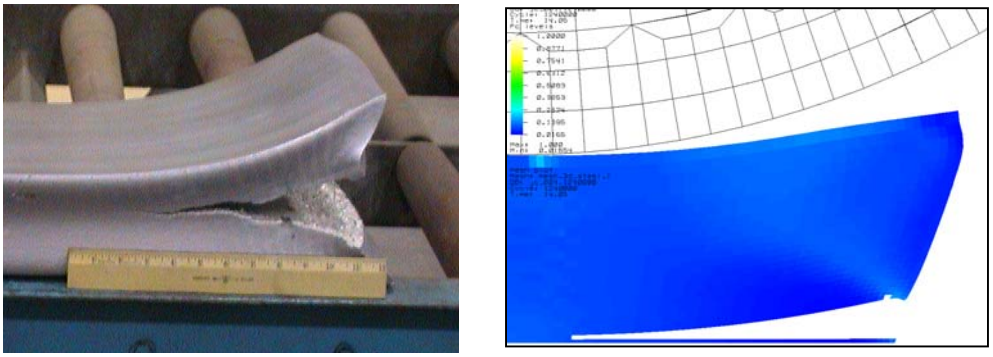


Figure 1. a) Damage at notch region (indicated by red color).



a) b)

Figure 2. a) Fractured ingot and b) simulation of center splitting

U.S. Department of Energy
Milestone Log

Development of a Rolling Process Design Tool for Use in Improving Hot Roll Slab Recovery

Identification Number	Description	Planned Completion Date	Actual Completion Date
1.	Constitutive model defined: PQ3	3/02	3/02
2.	Fracture model defined: PQ5	9/02	9/02
3.	Friction model defined: PQ3	3/02	3/02
4.	Finite element model constructed: PQ4	6/02	6/02
5.	Rolling data produced: PQ6	12/02	12/02
6.	Initial code validation studies completed: PQ8	6/03	6/03
7.	Validate models in a production configuration: PQ10	12/03	12/03
8.	Complete parameter study: PQ12	8/04	

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1910-040

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

OMB Burden Disclosure Statement

Public reporting burden for this collection of information is estimated to average 47.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, Records Management Division, HR-422 – GTN, Paperwork Reduction Project (1910-0400), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget (OMB), Paperwork Reduction Project (1910-0400), Washington, DC 20503.

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ne and Address PI: Richard Couch; Lawrence Livermore National Laboratory; L-99; P.O. Box 808; Livermore, CA		gram/Project Start Date 01 mpletion Date 08/31/04

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formance Variances, Accomplishments, or Problems

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atus Assessment and Forecast Due to late delivery of funding the conclusion of the project has been extended to 8/31/04.

☐ viation from Plan is Expected

11. Description of Attachments

[x] None

12. Signature of Recipient and Date	13. Signature of U.S. Department of Energy (DOE) Reviewing Representative and Date